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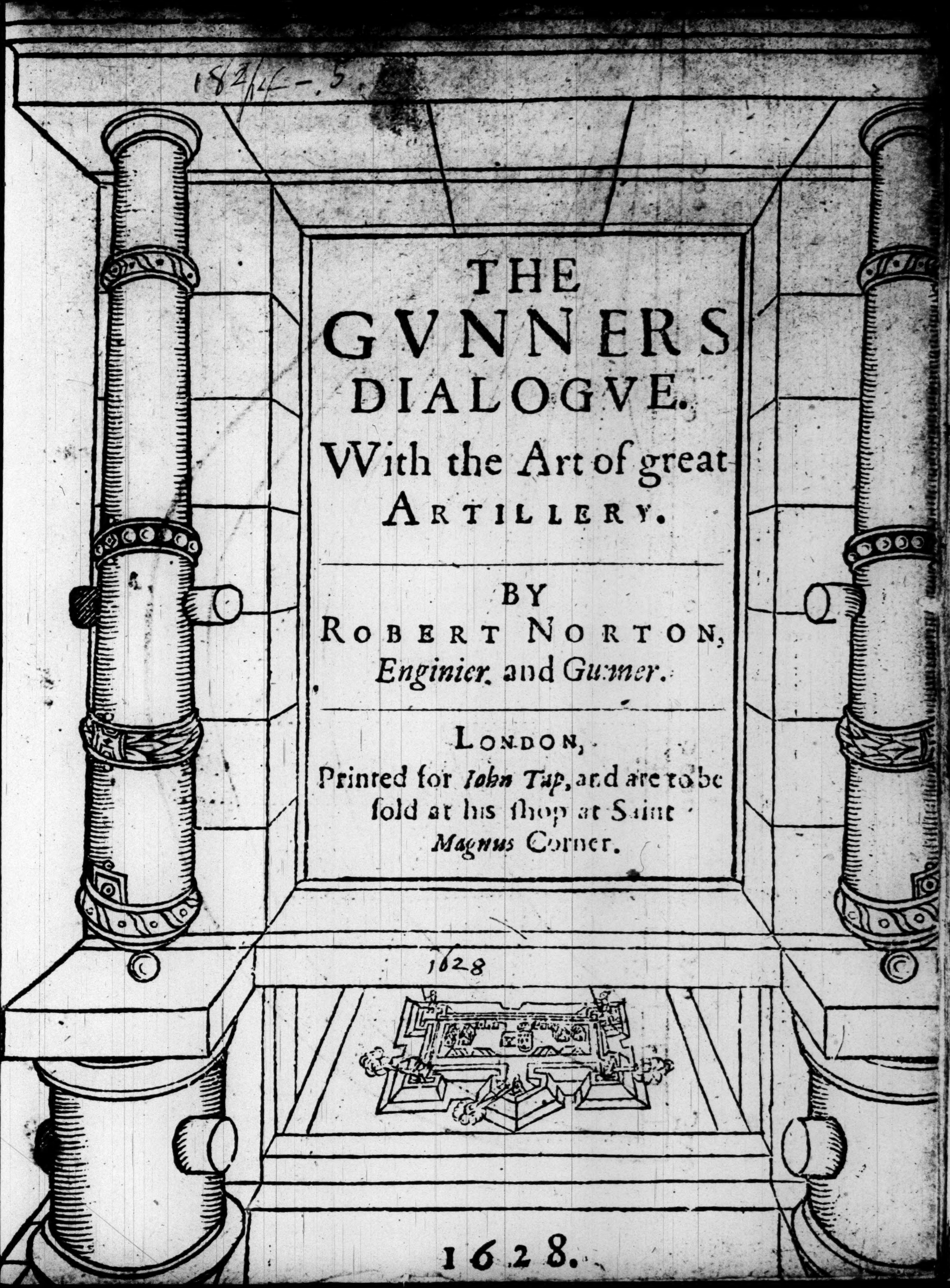

THE GVNNERS DIALOGVE.

With the Art of great ARTILLERY.

BY
ROBERT NORTON,
Enginier. and *Gunner.*

LONDON,
Printed for *Iohn Tap*, and are to be
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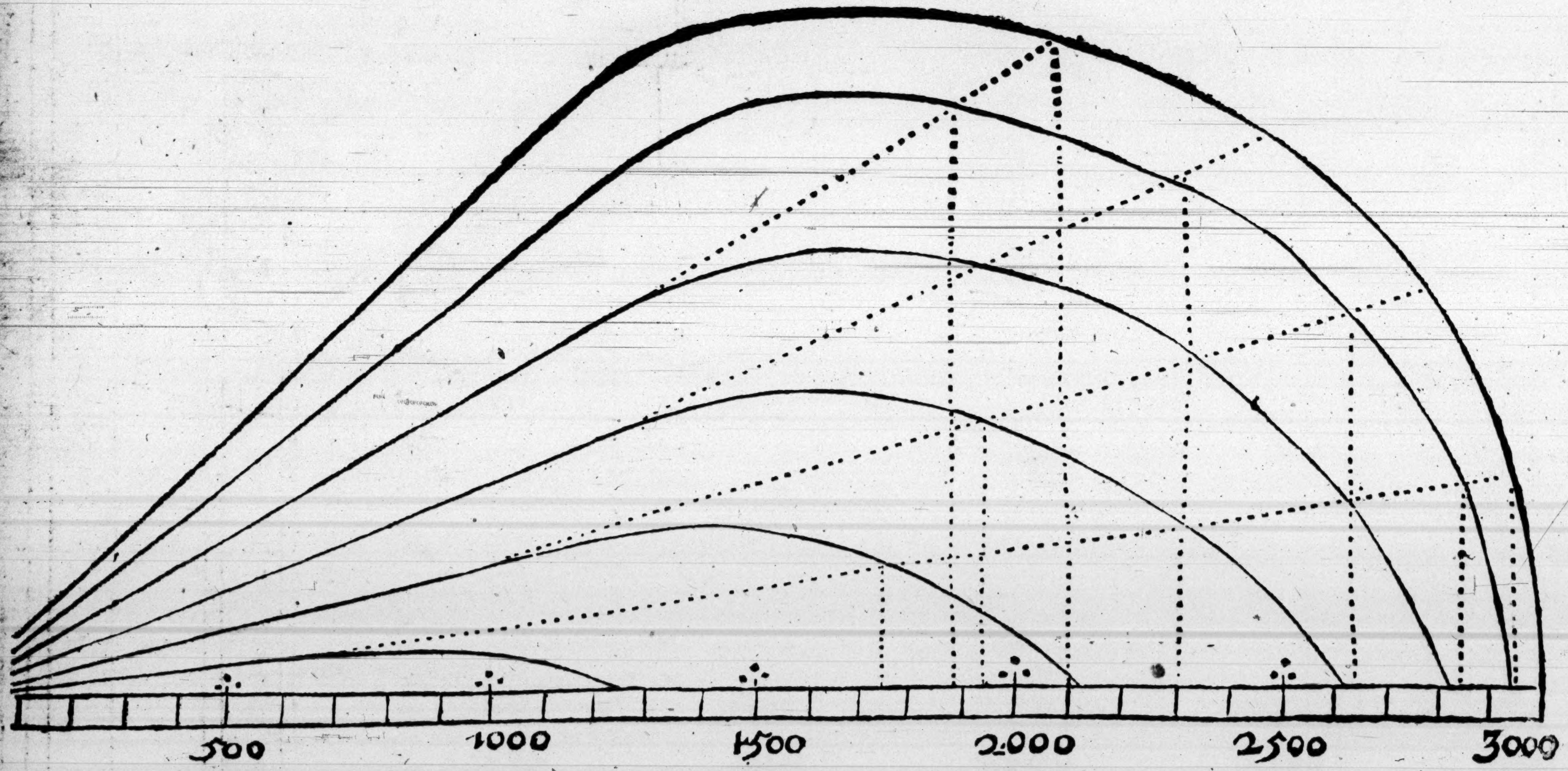
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TO THE MOST ILLVSTRIOVS PRINCE the DVKE of *Buckingham* *His Grace*, &c.

S*Eeing that amongſt all the Arts (moſt Excellent* Duke) *that adorne the life of Man vpon Earth,* Warre *is that higheſt, worthieſt, and moſt commodious* Science *that great Princes ought to preferre before all others, were it but for* Cicero *his reaſon,* Vt ſine iniuria in pace viuamus; *Peace being by inſtinct of* Nature *of all men moſt deſired, And warre by the greateſt* Emperours *and* Princes *of the world euer with Sword and Pen moſt highly magnified, ingenuouſly finding therein innumerable inuentions, and diuers ſubtill ſecrets, and admirable deuices,* Engins *and* Stratagems *to ouercome their* Enemies *with; yet none comparable to the Art and Practice of* Artillery, *comprehending in it the greateſt matter of importance of our* Militia *at this day. And finding alſo* (Great Duke) *many ardent magnanimous minds to coole, for want of ſpeculation to inuent, and diuers Heroike actions to paſſe by vnatchieued, for want of practice to performe, I, the meaneſt of many, hauing with long*

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practice, and no ſmall ſtudy, and ſome coſt, beene ſomewhat inſtructed and conuerſant therein; and ſeeing the penury of expert Gunners, *and vnderſtanding men, and the weakneſſe of the preſent meanes to breed more hereafter, I haue for aid formerly offered my poore Talent, called the* Art, *and the* Practice of Artillery. *And now alſo depending vpon your* Graces *fauour, preſume to offer theſe few lines, called the* Gunners Dialogue, *vnder your Excellencies Patronage, as well to further others therein, as herein to ſhew ſome part of my thankfulneſſe for your* Graces *fauour, that it pleaſed you to imploy my ſeruice, were it but to view and cenſure other mens workes (I being not naturally ſcrutinous) wherein I proteſt I faithfully related to your* Grace, *my poore opinion truly, if not iudiciouſly, the effect, if they be put in practice will manifeſt, but certainly cleere it was from all partiality or enuy, as might appeare by my preferring* Salinors *Booke Leſſon, he a Forreiner, before my Country man* Iones *his vnexperienced inuentions, both ſtrangers to my acquaintance. Accept therefore, I beſeech your* Excellencie, *this ſmall vnworthy Preſent; ſo ſhall I be encouraged with your* Highneſſe *fauour and leaue, to publiſh my* Treble Architecture, Ciuill, Military, *and* Marine, *almoſt ready for the Preſſe; if theſe ſpeed with fauour, which will impreſt my ſeruices, to attend your* Graces *future pleaſure, and engage me to reſt*

Deuotedly ready
at your Excellencies
command,

Robert Norton.

THE GUNNERS DIALOGUE.

Queſtion 1.

How many things ought a Gunner *to vnderſtand, and bee able to performe, before hee take vpon him the charge of* Ordnance?

Anſwer. Very many, as to know the Force and Nature, Refining, Cleanſing, Rectifying and Receits of the Materialls, for the making and renewing of *Gun-powder*. The *Names, Proofes, Vſes, Bore, Length, Weight* and *Fortification* of euery Peece, and each part thereof. The *Vent* and *Weight* of all manner of Shot of any height, *Metall, Stone* or *Receipt* named; what quantitie of any ſort of *Powder* is due for the loading of each Peece, for any Shot aſſigned, to ſhoot effectually at any Marke within the Peeces Right Range, called *Point blanke*, or Dead-range, or vtmoſt randon Leuell, Mounted, or Imbaſed, and many others.

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Queſt. 2. *How ought he to be qualified, and goe prouided?*

Anſ. With many good parts and needfull things, as reading, writing, Arithmeticke to caſt vp proportions, Geometry to meaſure lines ſurfaces and bodies, with Diſcretion to gouerne his many affaires and occaſions, with vigilant and diligent care to keepe ſafe his powder and Ordnance from vntimely miſchances and dangerous accidents: he ſhould not be amongſt his *Guns* without his Horne furniſhed with Priming powder, and his Caſe with all ſorts of Priming irons, his Sword, Steele, and Tinderbox to light a match at pleaſure, ready to defend himſelfe and his charge from iniuries.

Q. 3. *What are the names, and vſes of our vſuall* English *Ordnance?*

A. Firſt, the double *Canon* or *Cannon* of eight inches high, and the whole *Canon* or *Cannon* of ſeuen inches high in bore, and the Di. *Canons*, and ſecondly the whole and Demy Culuerings, all which are vſed in Batteries, eſpecially the *Canons*, by reaſon the greater weight of their ſhots doe batter and ſhake a wall or defence, more than lighter ſhot could doe; the *Culuerings* are moſt commonly to reach farre off, and yet to beat into a ſtrong oppoſing marke or obiect, with a large Orafice. Thirdly, the *Saker*, *Minion*, *Falcon*, or *Falconet* &c. ſhooting alſo iron caſt ſhot (as all the forenamed Peeces doe) are to ſhoot at ſtrong and hard reſiſting obiects and markes alſo farre off, but the latter being of lower height in bore ſhooting leſſer ſhot, do conſequently pierce ſmaller holes then the former. Fourthly, the Periors, as the *Canon*

Perior, *Periera*, *Fowler*, Port Peece &c. that ſhoot either ſtone ſhot, murdering ſhot, or Fire-workes, either Cambred, that is, hauing a leſſer bore backwards, wherein the charge of Powder is to lye, as the *Bambard*, *Canon Periors*, and our *Drakes* haue. Or elſe they are chambred, and hauing Chambers to put in behind their chaſes to load them with, as the *Fowler* Port-peece, *Slings*, *Portingale Baſes* haue.

Q. 4. *What and how many are the Simples or Materialls of Gun-powder, and their qualities, and how are they to be Refined, and proportionally Mixed or Compounded together?*

A. The Simples whereof Powder is made and compounded, are only three, namely, *Salpeter*, which is the *ſoule*, and *Sulpher*, which is the *Life*, and *Cole*, which is the *Body* thereof. For the qualities, *Salpeeter* will rarifie, being fired, and turne into wind, which cauſeth the force. The *Sulpher* will kindle, and take fire quickly; and the Coale will maintaine the fire and carry them vp together. *Salpeter* is beſt refined, being diſſolued in a little water, and boiled & ſcummed, being ſet to congeale, it will in part ſhoot like Iſicles into roch, which is the beſt; the reſt may be either ſo refined again, or cleanſed from the Feces of greaſe, Alum and ſalt which accompany it. *Sulpher* is cleanſed by melting it often, and ſtraining it thorow a ſtrong canuas cloth. The Coale if it be well burned of Alder, Hazle, birch and young wood without barke or knot, will alſo be rectified for the purpoſe. When a quantity of Powder is to be made, firſt reſolue of the vſe, whether it be for *Ordnance*, *Musket*, or *Piſtoll*, for *Ordnance*, called *Canon* Powder greaſe,

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or the Receit called foure, one and one. And for the *Musket*, called *Hargubuſſe* Powder, and for *Piſtoll* fine Powder, the firſt is of fiue, one and one, the latter of ſix, one and one, by which is meant foure, fiue, or ſix parts of *Peeter*, to one part of *Sulpher*, and one part of *Coale*.

Q. 5. *How much Powder is it fit to allow each Peece for proofe, and for Action?*

A. For the *Cannons* proofe $\frac{4}{5}$ and for ſeruice $\frac{1}{2}$ of the weight of her iron ſhot, for the *Culuering* and leſſer *Ordnance*, the whole weight of their proper ſhots for proofe, and for Action for the *Culuering* $\frac{2}{3}$, and for the *Saker* and *Falcon* $\frac{4}{5}$, and for leſſer Peeces the whole weight in Action vntill they grow hot, for then muſt abatement be made with diſcretion. But in proofe the ſmall Peeces ſhould haue once and $\frac{1}{3}$ of Powder that the ſhots weigheth.

Q. 6. *What if Ordnance Powder of 4.1.1. be wanting, and yet Hargubuſſe or fine Powder be in ſtore, how will you then proportion your Charge?*

A. For the

	4.1.1.	5.1.1.	6.1.1.
Canon Double of 8	40 ℔	37 ℔ $\frac{1}{4}$	35 ℔ 6 oz
Whole of 7	33 ℔ $\frac{1}{4}$	31 ℔ $\frac{1}{3}$	29 ℔ 7 oz
Demi Cannon	20 ℔	18 $\frac{2}{3}$	17 ℔ 9 oz
Culuering	15 ℔	13 ℔ $\frac{3}{4}$	13 ℔
Demi Culuering	7 ℔	6	5 $\frac{1}{4}$
Saker	4	3 $\frac{1}{2}$	3 $\frac{1}{4}$
Minion	3 $\frac{1}{2}$	3 $\frac{1}{4}$	3 ℔
Falcon	2 ℔	1 $\frac{3}{4}$	1 ℔ 9 oz

Cannon Per. $\frac{1}{3}$ of the ſtone ſhot in powder with diſcretion abating 5 li *pro Cent*.

Q. 7. *If Scales and Ladles be wanting, how many Dyameters of the ſhots height in powder will make a reaſonable charge for any Peece aſſigned?*

A. For the Canon 2 $\frac{1}{2}$, for Culuering 3, and for the Saker 3 $\frac{1}{2}$, for leſſer Peeces 4 Diametres of the Cillinder. For 3 Diametres make $\frac{2}{3}$, and 3 $\frac{2}{3}$ make $\frac{4}{5}$, and 4 Diametres and $\frac{1}{2}$ make the whole weight of a caſt iron ſhot, it being corne powder; which length will alſo ſerue for the meaſure of Cartredges for the like Peeces.

Q. 8. *What proportions are betweene each of thoſe ſorts of powder, namely betweene* 4. 1. 1. *and* 5. 1. 1. *and* 6. 1. 1. *concerning their Forces?*

A. From the firſt of 4. 1. 1. to the ſecond of 5. 1. 1. the proportion is as *6* to 7, *viz.* $\frac{1}{7}$ difference. And from the firſt to the third of *6*. 1. 1. is as *6* to 8, which is $\frac{1}{4}$, and the ſecond to the third, is as 7 to 8, which is $\frac{1}{8}$ in Force augmentingly more.

Q. 9. *What are the vſuall weights of each ſhot being either of Lead, Iron, or Stone?*

A. I haue here ſet them ſeuerally downe in manner of a Table, wherein the firſt Columne ſignifieth the height of the Diametre of any ſhot between two and eight inches height, and the parts proceeding from quarter to quarter ſucceſſiuely.

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Inches,	Lead,	Iron,	Stone.
2	$1^{li}.11^{oz}$.	$1^{li}.1^{oz}$.	$0^{li}.7^{oz}$.
2¼	2—0	1—9	0—9
2½	3—0	2—2	0—12
2¾	4—3	2—14	1—0
3	5—0	3—12	1—4
3¼	6—9	4—12	1—8
3½	8—1	6—1	2—0
3¾	9—14	7—5	2—7
4	11-5	8—15	2—13
4¼	15-15	10-10	3—10
4½	17·15	12-10	4—3
4¾	21-5	14 14	5—9
5	24·12	17-5	6—3
5¼	30 0	20·1	7—8
5½	35-10	23-2	8—14
5¾	39·9	26-6	10·10
6	45·0	30·0	11-4
6¼	51-0	34·0	12-12
6½	57-0	38-0	14-3
6¾	63-0	42-0	15·12
7	72-0	48-0	17-10
7¼	79 8	53-0	19-14
7½	87-0	58-0	21-12
7¾	96-0	64 0	24-0
8	106	72-10	26-12

Q. 10. *How much is the height of the Bore, length of the Chace, weight of the Peece, weight of the powder, and length of the Ladle, proper to each Peece?*

A. I haue here alſo ſet them downe in a Table ſor the keeping them the better in memory, as followeth.

Names

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Names of the Peeces,	Height of Bore, Inches,	Length in Diametres,	Weight in Metall, Pounds,	Weight of Powder,	Length of the Ladles Inches.
Cannon of 8	8	15	8000	40^{li}	24
Cannon of 7	7	16	7000	25^{li}	22
Demi Cannon	$6\frac{1}{2}$	18	6000	20^{li}	21
Culuering	$5\frac{1}{2}$	28	4500	15^{li}	20
Demi Culuering	$4\frac{1}{2}$	32	2500	9^{li}	18
Saker	$3\frac{1}{2}$	36	1500	$5^{li}\frac{1}{4}$	16
Minion	$3\frac{1}{4}$	30	1200	$3^{li}\frac{3}{4}$	15
Falcon	$2\frac{3}{4}$	42	700	$2^{li}\frac{1}{2}$	14
Falconet	$2\frac{1}{4}$	48	500	$1^{li}\frac{1}{4}$	12
Cannon Perior	9.10.12	8	3500	3^{li} $3^{li}\frac{1}{3}$ 4^{li}	3
Demi Can. Drake	$6\frac{1}{2}$	16	3000	9^{li}	$4\frac{1}{2}$
Culuering Drake	$5\frac{1}{2}$	16	2000	5^{li}	$4\frac{1}{2}$
Demi Cul. Drake	$4\frac{1}{2}$	16	1500	$3^{li}\frac{1}{2}$	$4\frac{1}{2}$
Saker Drake	$3\frac{1}{2}$	18	1200	2^{li}	$4\frac{1}{2}$

Q. 11. *How and what is it to Tertiate and meaſure any Peece, and how much ought they to be in thickneſſe of Metall at their* Touch-holes, Truions, *and* Neckes ?

A. There are three differences in Fortification of each ſort of Ordnance, be they of the kindes of *Cannons*, or of *Culuerings*; For they are either ordinarily Fortified, or leſſened, or double fortified, and common or *Legitimate* Peeces, *Baſtard* Peeces, or *Extraordinary* Peeces. For the *Cannon* double Fortified, hath fully one Diametre in thickneſſe of Metall at her *Touch-hole*, and $\frac{11}{16}$ at her *Trunions*, and $\frac{7}{16}$ at her *Necke*, whereas the ordinary fortified *Cannons* haue but $\frac{7}{8}$ at at the *Touch-hole*, and $\frac{5}{8}$ at the *Trunions*, and but $\frac{3}{8}$ at the *Necke*. And the leſſened *Cannons* haue at the *Touch-hole* but $\frac{3}{4}$, and at the *Trunions* $\frac{9}{16}$, and at the Necke $\frac{5}{16}$. Now all the double fortified *Culuerings*, and all leſſer Peeces of that kind, haue one diametre and $\frac{1}{8}$ in thickneſſe of Metall at the *Touch-hole*, and $\frac{15}{16}$ at the *Trunions*, and $\frac{9}{16}$ at the *Necke*. And the ordinary fortified *Culuerings* haue like to the double fortified *Cannons*, but one diametre of Metal in thickneſſe at the *Touch-hole*, $\frac{11}{16}$ at the *Trunions*, and $\frac{7}{16}$ at the *Necke*. And the leſſened *Culuerings* haue $\frac{7}{8}$ at the *Touch-hole*, and at the *Trunions* $\frac{5}{8}$, and at the *Necke* but $\frac{3}{8}$, as the ordinary fortified *Cannons* haue.

Q. 12. *What are the difference betweene the* Common *or* Legitimate *Peeces, and the* Baſtard *Peeces, and the* Extraordinary *Peeces?*

A. Common or *Legitimate* Peeces are ſuch Ordnance as haue a due length of their Chaſes proportioned according to the height of their proper Bores, euen as they are expreſſed in the laſt precedent Table, *Baſtard* Peeces are ſuch as haue ſhorter Chaſes than the proportion of their Bore doth require: and *Extraordinary* Peeces, are ſuch Ordnance as haue longer Chaſes than the proportion of the Bore alloweth. And they are called *Baſtard Culuerings*, and *Extraordinary Culuerings*, and ſo *Baſtard Saker Faulcons*, or *Extraordinary Sakers* or *Faulcons*, &c. accordingly as their Bores come neareſt to the *Culuering*, *Saker*, or *Falcon* Bores, &c.

Q. 13. *How will you finde whether a Peece of Ordnance be cleare from Flawes, Crackes, and Hony combes?*

A. Hauing firſt clenſed and cleared the Peece with a Wad-hook and Ladle, from all loading, foulenеſſe, duſt and ſtones, which you may know by putting in the Rammer head vp to the Breech, and with a priming iron put downe into the Touch-hole, if it take hold of the Rammer head, it is cleare of loading and ſtones, then the Ladle and ſpung will get out the duſt. But to know whether any Crackes, Flawes, or Hony-combes be within her Chaſe or Chamber, put in an vſuall *Searcher*, made with two or three ſprings with points like great pinnes heads, bending outwards, which being bended together with your hand, vntill it will enter into the mouth of the Peece, and that put vp to the bottome of the Bore, and turned round in the motion of pulling it in and out of the Chaſe; ſo if any Hony-combes be therein, it will ſticke with the points in the ſaid Flaw, Crack or Hony-combe. Alſo in a ſun-ſhine day, with a looking-glaſſe, the Sunne beams may ſo be reflected into the Chaſe, as that all flawes, crackes and ſpungie Hony-combes may be diſcerned. Or if the Sun ſhine not, a

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Wax candle lighted and put vpon the end of a halfe Pike, or a bright Sword, will alſo reflect the Sunne-beames, as afore-ſaid. Now if no flaw be found, you may proceed to her proofe, but if any be therein, that Peece is dangerous for breaking, and ſecond lading, and had need to be carefully proued, and reſpectiuely handled, leſt in Lading the ſecond time, any fire remaine therein to enflame the ſecond Charge. Therefore, if any ſuch Peece muſt needs be vſed, you muſt not neglect to ſpunge her well firſt, with a wet ſpunge. And alſo after ſpunging, aduiſement taken, not to allow ſuch Peeces the ordinary lading of powder, but with diſcretion an abatement muſt be made, more or leſſe, according as the fault or defect is found to be more or leſſe.

Q. 14. *What if the mouth of a Peece be growne wider then the reſt of her Chaſe within, by meanes of wearing, how will you chooſe ſhot fit for her?*

A. I will trie with ſeuerall Rammers heads, or if need be, Face them by little and little, vntill I thereby finde the loweſt bore within the Chaſe (except the *Camber* be Taper-bored, as the *Drakes* and ſome *Periors* are) and then fit my ſhot to that loweſt bore, alwayes allowing $\frac{1}{20}$ of that height for vent.

Q. 15. *What if you be commanded to ſerue with a Peece that hath lyen long charged, that either the ſhot is growne faſt to the inſide of the Peece with ruſt, or the ſhot being torted too high, or ouall doth ſticke by the way, and ſo may be dangerous for Peece, and Gunner diſcharging it?*

A. I wil not aduenture to diſcharge a Peece ſo long loaded, as I may not know what accidents ſince haue hapned, but with a Wad-hooke will draw the Wad, and try with the Ladle to draw or moue the ſhot; which if I cannot doe, I will firſt eleuate her, and powre warme water in at her mouth (and ſtop the Touch-hole) to diſſolue the Petre, and eight or ten houres after, I will vnbaſe her,(ſetting a veſſell vnder her mouth) to receiue the liquor that ſhal drain out; then a day or two after I will put in a ſmall quantitie of drie powder at the Touch-hole, and try if I can blow out the ſhot therewith, if not, I will then powre in warme oyle and vineger, and turne her round, ſo that the vpper ſide may be ſide-wiſe and downwards in that motion; then with her Ladle or Rammer, or both, I ſhall doubtleſſe looſen the ſhot, and ſo draw it, or blow it out, otherwiſe the Peece will be euer after vnſeruiceable without new founding.

Q. 16. *What Inſtruments are moſt fit for a Gunners vſe?*

A. The Callibre Compaſſes, Height-boord, Inch ſight-rule, Gunners Scale, Gunners Quadrant diuided into ninetie degrees, and into twelue points and their minutes, with a Geometricall ſquare to take mountures, leuels, heights, breadths, and diſtances, and a paire of ſtraight pointed Compaſſes.

Q. 17. *How doe you diſpart a Peece or Ordnance, what is it, and to what end vſed?*

A. To diſpart a Peece, is to finde the difference betweene the Diametres or thickneſſe in metall before at the Muzle-ring, and abaſt at the Baſe-ring, for in true bored Peeces the halfe of the difference of their Diametres is the due diſpart. Thoſe Diametres are readily found by the Callibre Compaſſes opened

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and applied to the oppoſite ſides of thoſe Rings, and to a Scale or Inch-rule of ſmall equall parts, whereby the difference will ſoone appeare, which halfed is the diſpart found. Their Diametres differences alſo may bee found by guirting them with a labell of parchment or cord, that will not ſhrinke nor ſtretch, diuiding the guirt in three equall parts at each time, ⅓ may be tollerably accepted for the Diametre. Alſo in true equall bored Peeces, putting in a Priming iron at the Touch-hole, to the bottome of the bore, and marking a place vpon it equall in height to the Baſe-rings higheſt part, which applied vpon the bottome of the bore at the mouth, perpendicularly, will ſhew the length of the diſpart aboue the higheſt of the Muzle-ring. Likewiſe you may finde both thoſe Diametres by laying a rule or ſtraight ſtaffe leuelly, making a Tangent on each of thoſe Rings ſeuerally, and on each ſide of the Peece holding a plummet line, ſo that it onely touch the ſides of the metall of each Ring, the differences betweene thoſe Diametres ſo found halfed, is the diſpart ſought. It may be found many other wayes, but theſe being ſufficient, I will only anſwer concerning the end and vſe thereof. It ſerueth to direct the ſhot to the marke, or ſo neere as is the diſtance betweene the two parallels that are made by the two continued lines, the one the Axis of the bore, the other the viſuall line that paſſeth from the Gunners eye by the higheſt part of the Baſe-ring and top of the Diſpart vnto the marke. For ſeeing the Breech of the Peece is of ſolid metall, not ſo tranſparant that the Gunner can viſually apply the Axis of the bore preciſely to the marke, it muſt ſuffice to finde the other viſuall line, being the neereſt that can parallelly betaken thereunto, and accept it, for the ſame.

Q. 18. *How much will you allow for vent, comparing the height of the ſhot with the height of the bore of the Peece aſſigned?*

A. One twentieth part will be ſufficient, approued ſo to be by the beſt Gunners of late times, although many Gunners of *England* generally allow a quarter of an inch for each ſhot to be lower then the bore of of euery Peece, which is too little for a *Cannon*, but too much for a *Falcon*, and for leſſer Peeces.

Q. 19. *What difference is there betweene ſhooting by the metall of the Peece, and by the Diſpart, to direct a Peece to a marke leuell or eleuated?*

A. Their differences are ſomewhat vncertaine, becauſe there are ſeldome any conſtant proportions held in founding Ordnance, concerning the eminencies of their Baſe and Muzle-rings; but in moſt Peeces they are ſo, that firſt laying the Peece to the mark with a due Diſpart, and then by the metall, obſeruing with a Quadrant, you ſhall ſometimes finde that the Peece will be eleuated more by the metall, then by the Diſpart, foure degrees, fiue degrees, yea ſometimes ſix or ſeuen degrees. And ſo accordingly will the Randons of the metall bee more then the Randons of the Diſpart, which (by the Table of dead Ranges for each degree here annexed, or by the Gunners Scale) may for euery eleuation be made certainly knowne. But on the leuell the metall rangeth neare double the diſtance of the Diſpart, in moſt Peeces.

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A Table of Randons, or Dead Ranges, for euery degree vnto the beſt Randon, or fortie degrees.

Degrees,	*Paces*	*Degrees,*	*Paces*	*Degrees,*	*Paces*	*Degrees,*	*Paces*
1	500	11	1487	21	2225	31	2712
2	610	12	1575	22	2285	32	2747
3	717	13	1655	23	2342	33	2780
4	822	14	1735	24	2397	34	2810
5	925	15	1812	25	2450	35	2837
6	1025	16	1887	26	2500	36	2872
7	1122	17	1960	27	2547	37	2195
8	1218	18	2030	28	2592	38	2920
9	1310	19	2097	29	2635	39	2955
10	1400	20	2162	30	2675	40	2988

Degr.	*Paces.*
41	2990
42	3000

Q. 20. *How ſhall a Gunner know how the Range of his Peece encreaſeth, or decreaſeth, from degree to degree?*

A. Firſt, hee muſt finde by the Table or Right ranges, expreſt in the Art of *Great Artillery*, or otherwiſe; how much the leuell right range of your Peece is, which number of paces diuide by 25, and multiply the Quotient by 11, and the product will be the firſt and greateſt digreſſion, which is betweene the firſt and ſecond degrees, which diuide by fortie the degrees contained betweene the firſt degree and 42 degrees, the beſt or vtmoſt Randon, and the Quotient ſhall be the number of paces that the ſhot ſhal loſe at euery digreſſion from degree to degree to the beſt Randon, and contrariwiſe for their increaſing digreſſion from 42 degrees, the vtmoſt Randon downe to the firſt degree.

Q.

Q. 21. *At how many degrees of Mounture, will any Peece conuay her ſhot fartheſt, called her vtmoſt Randon?*

A. At about 42 degrees, neuertheleſſe, that 45 hath formerly beene generally taken for the beſt or vtmoſt Randon, being the middle or meane degree betweene the leuell and the perpendicular, namely, the halfe of ninety degrees: But becauſe the Peece on the leuell Rangeth a ſhot about one tenth part of the vtmoſt Randon, as it doth alſo at 84 degrees of Mounture; therefore it ſtands with more reaſon, and experience alſo hath found, that the vtmoſt Randon of any Peece ſhould be (being duly charged and diſcharged) at 42 degrees, the halfe of 84 degrees of eleuation.

Q. 22. *How doe you direct your Peece to ſhoot at a marke, being for diſtance, within the Straight line, or Right range of the Peece, and lying leuell with the Horizon?*

A. Hauing placed the due Diſpart vpon the Muzle-ring, as in my 17 Anſwer before is ſhewed. Then (both my thumbs being placed cloſe ouer the vppermoſt point or part of the metall of the Baſe-ring) I will cauſe the Peece to be trauerſed, and coined more or leſſe, vntill I eſpie (thorow betweene my thumbs) the top of the Diſpart and the marke to be in one, and then I giue fire and expect a good and faire ſhot.

Q. 23. *But how will you direct a Peece of Ordnance to ſhoot at a marke that lieth leuell, but is further diſtant then the Peece can reach vpon her leuell Range, you hauing only ſome certaine dead range, and the diſtance from that Peece to the marke giuen; what aduantage will you take to reach the marke, to make a faire ſhot at the firſt time?*

A. Hauing a certain Dead range for any eleuation

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of that Peece giuen, I repaire to my *Gunners Scale*, or to the laſt precedent Table of Randons or Dead ranges, with the Rule of Proportion, ſaying, if the number of the Paces of the Dead range giuen, doe giue the eleuation giuen, what ſhall the Diſtance giuen, giue; multiply the third number by the ſecond, and diuide the product by the firſt, and the Quotient will be the number of degrees that the Peece muſt be mounted vnto, to reach that marke.

Q. 24. *What if the marke be eleuated aboue the leuell, and be farther diſtant then the Peece vpon that mounture can reach in a Right range: How will you direct your Peece for aduantage, hauing the Diſtance and ſome certaine Dead range of that Peece giuen?*

A. Firſt, either by my *Gunners Scale* for degrees, or by the Table following, for the ſix points of the *Gunners Quadrant*, whereby you may ſee the vttermoſt Dead range being 3000 Paces, that the aſpect of the firſt point cutteth the Range of the ſecond point at 1880 Paces of the leuell, and the third Range at 2330 Paces, &c. And that the aſpect of the ſecond point interſecteth the Range of the third point at 1950 Paces.

Ranges

Aſpects 1	1	2	3	4	5
2	1880	0	0	0	0
3	2330	1950	0	0	0
4	2650	2340	1890	0	0
5	2860	2650	2330	1900	0
6	3000	2960	2500	2090	1650

And the Range of the fourth point at 2340,&c. And that the Aſpect of the third point doth interſect the fourth Points Range at 1890, and the fifth Points Range at 2330, and the ſixt at 2500 Paces. And that the Aſpect of the fourth point interſecteth the fifths Range at 1900 Paces, and the ſixths at 2090. And laſtly, that the Aſpect of the fifth point cutteth the ſixths Range at 1650, As the Diagram doth alſo ocularly ſhew.

Q. 25. *How make you vſe of the Scale and Table?*

A. As in the former by the Rule of Proportion, ſaying, if the dead Range giue the Tabular number of dead Ranges proper thereunto, what ſhall the number of the Scale Diagram, or of this Table, proper to the Aſpect and Range cut, giue; multiply the third number by the ſecond, and diuide the product by the firſt, and the Quotient will be the number of Paces proper for the Peece and marke aſſigned.

Q. 26. *How will you endeuour to ſhoot farther then ordinary in one and the ſame Peece, with like quantities of powder and ſhot?*

A. Firſt I will gently put home all the Powder, and wad the ſame; then the ſhot being inuolued with paper, leather, okam, or ſuch like, to fill cloſe the concaue of the Bore, I will driue the ſhot cloſe to the Powder with a good wad, putting after it a Tampion of corke, and with a ſpunge a little moiſtened with an oyle, I will anoint the vacant Cillinder of the reſt of the concaue Chaſe; and will ſo baricado the Breech of the Peece with a Pile, wall, or ſuch like, as that it ſhall not reuerſe in the diſcharge: But eſpecially, if I haue time, I will ſtop the Touch-hole, and

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drill a new one more forwards, which will make the Powder all to fire, and ſooner together, and the Peece reuerſeleſſe, if it be rightly done.

Q. 27. *What Peece would you chooſe to ſhoot at a ſingle marke, and what courſe will you obſerue?*

A. I would chooſe ſuch a Peece as I had formerly practized to ſhoot in, and yet examine her to know her qualities: then in loading her, I will not ramme home her Powder too hard, leſt it in taking fire lye firſt blowing, and cauſe the Peece to ſtart from her poſition, duly directed by a true diſparture, that the Axis of her Bore may preciſely reſpect the marke. And laſtly endeuour to preuent all impedimentall Accidents.

Q. 28. *If you were to make a ſhot in the night, at a marke ſhewed you in the day, how would you prepare for it?*

A. I would firſt lay the Peece in her Carriage preciſely to the marke in the day, then with a Chalke-line dipt in Gum-water, I will ſtrike a right line on the vpper part of the metall from Breech to Muzle (while the line is yet moiſt) vpon which I will apply a good and ſure *Magneticall needle* or flye, with a Chart exactly diuided, and note the interſecion, then from the ends of the line that was marked or ſtriken vpon the metall I let fall plum-lines vpon the Platforme, and at the places where they touch, I knocke in at each a ſmall naile. Laſtly, with a Quadrant I obſerue the eleuation of the concaue; or elſe with ſome Staffe take the perpendicular height of ſome certaine place or marke made in the metall, as well at the Breech, as at the Muzle aboue the ſaid two nailes: And ſo you may againe lay the Peece thereby, alwayes to haue the ſelfe-ſame poſition, and ſo ſhoot as certaine at that marke by night as by day.

Q. 29. *How would you make a ſhot at an Enemies light, in a darke night, not hauing any Candle, Lanthorne, or other light by you?*

A. I would light two peeces of match, the one as much longer then the other as the quantity of the diſpart of the Peece, & ſet the longer vpon the vpper part of the Muzle-ring, & the ſhorter vpon the vpper part of the Baſe-ring, trauerſing or coining the Peece vntill I haue brought the light of the Enemies, and the lights of the two matches, all three in one; and ſo I doubt not but to make a good ſhot thereat.

Q. 30. *How would you chooſe and order a Peece, to make a good ſhot at a moueable marke; as at an enemies Ship vnder ſaile, Boat rowing, or Horſe-man riding?*

A. Firſt would I chooſe ſuch a Peece (as in regard of the diſtance, will be able in a ſtraight line to reach the marke) whoſe qualities I know. Secondly, hauing loaded the Peece, I obſerue how the Marke moueth. Thirdly, I will obſerue the wind (if it blow much) whether it be againſt, or with, me, or ſide-wayes, and accordingly take aduantage, for the impediment it may produce otherwiſe. Then will I, with the Diſpart conſidered, duely obſerue ſome cloud, or marke ſome point of Landskip that lieth in the courſe of his motion; and when according to the ſwiftneſſe thereof, he is come ſo neere it, as I gueſſe the ſhot and hee may meet at the marke, I ſo giue fire, wherein I may remember this ſecret of Nature, that any Peece will ſhoot further from Sea

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to Land-ward, then from Land to Sea-wards.

Q. 31. *What ſay you to ſhooting at a marke vnder the leuell from aboue downwards, how would you order matters to make an effectuall ſhot?*

A. That kinde of ſhooting is farre more vncertaine and difficile then any other, by reaſon of the ſmaller reſiſtance the ſhot makes againſt the force of the powder, naturally working vpwards, which is towards the Breech, if it were not there reſtrained, it therefore of all other wayes ſhooteth leaſt diſtance in a ſtraight line, vnleſſe it be perpendicularly downwards, or neerely ſo; beſides, no Author or Practitioner elſe, to my knowledge, hath diuulged any good vſe or order for the ſame. But I haue obſerued that the Randons for Imbaſures do ſomewhat neerely decreaſe from degree to degree vnder the leuell, with a double proportion to the decreaſe of the Morter Peeces mounture, aboue from the beſt Randon vnto ninetie degrees. Out of which obſeruation and experience I haue framed this Table, and for better helpe added an example.

A Table for Imbaſures.

Degrees,	*Paces*	*Degrees,*	*Paces*	*Degrees,*	*Paces*	*Degrees.*	*Paces*
0	150	6	137	20	90	60	10
1	149	7	133	30	60	70	6
2	147	8	129	40	40	80	1
3	145	9	125	50	18	90	0
4	142	10	120				
5	139						

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The vſe illuſtrated by example.

At eight degrees Imbaſement a ſhot at a marke being to be made with a *Saker* (for which Peece the Table was made) if the diſtance were leſſe then 129 Paces, then the Peece being able to reach the marke needs no aduantage: but ſuppoſing it to be 140 Paces, a leſſe Imbaſement muſt be then giuen, namely, at about ſeuen degrees, to reach the marke, as reaſon will conduce.

Q. 32. *Can you make a reaſonable ſhot at a marke, which by reaſon of interpoſition of ſome hill, houſe, wall, Rampart, or other impediment, you cannot ſee it?*

A. Yes, with a Morter Peece it is vſuall, if it be within her reach. And although the carriages of other Peeces, will few, admit to mount them ſo high as 20 degrees, yet by ſapping the Breech of the Peece, that is, by making a trench for the taile of the carriage to reuerſe in, being deſcended thereinto the wheeles ſtanding aloft: or by preparing a Timber-frame, ſo that the taile may be ſuncke, as betweene two Timber-logs ſquared, the wheeles reuerſing vpon them, any Peece may be ſo mounted to ſhoot at a mark out of ſight, further then any Morter Peece can reach, or by taking a Peece out of her carriage, and mounting her accordingly vpō skids at pleaſure to the eleuation deſired; theſe may ſhoot *Granadoes, Flaming* or *Venomous bals*, and *Hedge-hegs* or ſuch like moſt neceſſarily. But amongſt them the *Canon Periors, Perieraes* and *Bombards*, are chiefly to be therefore preferred. Hauing then the diſtance giuen, Stales and Signals are to be placed, to ſhew where the marke is,

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which way, and how the ſhot lighteth ſhort, ouer, or wide, that ſuch errour may at the next time be reformed.

Q. 33. *How would you order things, to ſhoot at a Squadron of the Enemies Souldiers, and what Peeces would you chooſe?*

A. According to the diſtance I would chooſe a Peece that in a ſtraight line can ſhoot home, if I may, be it with *Demy Culuering*, *Saker* or *Falcon*, and plant my Peece as neere parallel to the champion Plaine as I can, that the ſhot may range, and ſhoot at girdle height, vnleſſe the ground be ſtony, for then would I place my ſhot ſhort of them, that grazing amongſt the ſtones, the ſtones may doe them more ſpoile then the ſhot of it ſelfe can doe, by farre; but in no caſe would I ſhoot wide, or ouer them, for that were both loſſe and ſhame alſo.

Q. 34. *At the time of ioyning of two Armies in Battell, how would you plant and mount your Ordnance?*

A. There are diuers opinions therein; ſome ſay it is beſt to plant them in the Front, to diſorder the Enemie, and cauſe them to breake their Ranks at firſt; which others diſliking, ſay, that will hinder their own party from many aduantages, and difficult to retire them: ſome would plant them in the Flanckes: And ſome would haue ſome of them in the Front, & ſome in the Flanke: And laſtly, ſome would haue them behinde the Armie, that vpon a ſigne giuen, their owne Squadrons may open a way for the *Gunner* to play vpon the Enemies Troops or Squadrons. But whereſoeuer they are planted, care muſt be had, that the Musketiers, appointed for guards, nor any other fire armes, approach within 100 Paces of the Ordnance, leſt vntimely firing them worke miſchiefe to the party. But hauing viewed before-hand the place appointed for the Battell, if any eminent riſing-place be there neere, to lodge the Ordnance thereon, they may thence moſt ſafely play vpon the Enemie in Front, Flanke and Trauers, with wonderfull aduantage and hope of victory.

Q. 35. *Hauing found the firſt ſhot faulty, to the right or left hand, ouer or ſhort, how will you at the next amend it, to make an effectuall ſhot?*

A. If it were wide, towards the right or left hand, I would place my eye on the Baſe-ring, at the next time, a little more to the ſame ſide, accordingly more or leſſe: if it were too high, direct the top of the Diſpart vnder the marke as much: if too low, lay ſome ſmall ſtone or ſtraw on the higheſt of the Baſe-ring, and by that, bring the diſpart and the Mark into one with diſcretion.

Q. 36. *What if the Peece by often ſhooting be growne ſo hot that it is dangerous, vnleſſe it be reſted or refreſhed; how will you coole her?*

A. If the ſeruice be ſuch, as ſhe may not haue time to reſt, in that caſe, ſhe muſt be cooled with Spunges wet in Lee, which is beſt, or in vrin and water, or water and vineger, or with the cooleſt freſh or ſalt water; bathing and waſhing her within and without, vntill ſhe be come to her due temper againe; but if I may, I will reſt her one or two houres in twelue, and between whiles coole her euery tenth or twelfth ſhot.

Q. 37. *If the Touch-hole be cloyed with ſpikes, ſtones or ſuch like, and neceſſitie requireth the vſe of the Peece, what would you doe therein?*

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A. Not truſt to that which ſome appoint, by beating her on the Muzle with a woodden mallet, hauing powred warme oile in at her Touch-hole, to expect her cloying to fly out; nor to the ſetting of her Breech vpright, with her mouth ouer a fire, vntill ſhe be red-hot, and then (her metall being ſoft) to get out her cloying; but if I cannot blow it out, nor haue time to drill another new touch-hole more forwards, I muſt load her with powder and ſhot without wadding, and by a ſuſee, wet vent, or powder moiſtned into paſte, placed at the mouth, ſo as it may fire a traine within the Chaſe that I will there make to fire the charge, to auoid danger as much as I can, ſo I will giue fire to the vent, hauing formerly laid my Peece to the marke, as I haue already ſaid.

Q. 38. *If you be ſo driuen, that of neceſſitie you muſt leaue your Ordnance to the Enemie, what would you doe either with hope to recouer them, or elſe to make them vnſeruiceable, or breake the next time they ſhall bee diſcharged?*

A. If I haue no conueniencie to hide them ſo ſecretly, by burying them vnder ground, as that the Enemie ſhall not finde them, or be paſt hope that we may neuer come to the place to recouer them: Then would I lay all the Peeces croſſe a narrow ditch or trench, filled ſo with char-coales, or other dry fewell, to kindle, and heat them thorowly red-hot a good ſpace, which will cauſe the metall to become ſo britle afterwards, being cold, that they will not be able to endure the due charge of powder to be fired in them, but will break in peeces at their next diſcharge; or I can break them either in that britle place, by applying them with hard ſtrokes of a heauie commander, or by loading each Peece with more than a double charge, and vnder and about the ſhot driuing ſteele wedges with raminers of hard wood, ſo that hauing fired the Peece with a fuſee or ſlow pyramid of powder moiſtned like paſte; the ſhot in diſcharge running vpon the thicker parts of the wedges will conſtraine the Peece to breake: I know diuers other wayes with a touch to breake or ſpoile the Enemies Ordnance, but I thinke it not fit to ſpeake of it publikely.

Q. 39. *Being beſieged, to reſiſt aſſaults and defend the place, what Ordnance are beſt, and where placed, and how vſed?*

A. All Ordnance are vſefull, but for defence at a breach or narrow paſſage, *Canon Periors*, loaded with Lanthornes, filled with pible ſtones, Caſes of Baſe and Burre, old iron traſh chaind, langrell, croſſe bar, plugs, or any other tearing or murdring ſhot, or with a mine in their way to blow vp & the like; & planting the Ordnance couert ſo, as to ſcower the paſſage from a Flanker Caſſamat or other defence, or before the Breach. Alſo my new inuented Murtherers, that haue long ſquare tapering concaues, w^ch^ are double or treble in breadth to their heights, and will ſpread their murthering ſhot, Musket or Piſtol bullets, ſidewiſe far, but little vp and downwards (without feare of ſtop or cloying the Chaſe, as in equal round Peeces oft hapneth, when they are charged with ſmall looſe ſhot or traſh.) Alſo I will carefully prouide to haue in ſtore, ſpare Carriages, Axtrees, Wheeles, Cordage, Match, Powder, and Shot ſufficient; the rather, be-

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cauſe alwayes the Enemie will chiefly endeuour to ruine our Defences, embouch our Loops, beat downe our Parapets and Defences, cloy our Plat-formes, diſmount our Ordnance, teare our Carriages, Axtrees and wheeles with their Peeces, by all the means they can poſſible.

Q. 40. *You hauing beleagerd or beſieged a Fort or Towne, how would you ſhoot to ruine, annoy, or take away the enemies Defences; and what would you chiefly endeuour to doe?*

A. First, I would make choice of places to plant my Ordnance, or make my Batteries ſo againſt the weakeſt parts, to make a Breach in the moſt conuenient place, bringing them by Trenches, as neere as I can, within leſſe then two hundred Paces; and then hauing raiſed and plained the Terraplenes and Parapets, made the Plat-formes, cut and ſet out Loopes, or placed the Gabbions the whilſt, and planted Peeces where they may moſt offend the Enemie, endeuouring to ruine and embouch their Defences, plying them ſo hard, that they may not haue time to repaire the old, nor build new, nor retrench, as they elſe would doe. And alſo make what ſlaughter I can, to weaken the Aduerſary: and from each Battery fit, to ſhoot at the place for Breach, as many Peeces at once as can be brought to beare thereon: and I will obſerue what Peeces of theirs, moſt endammage vs & ours, and endeuour to diſmount them, and amaze and hinder their workes all I may. The diſtances of the Batteries muſt be according as the ſituation of the place will permit, but if poſſible, at eighty, an hundred, or an hundred and fifty Paces at moſt, auoiding the danger of the Enemies Musketiers with conuenient Defences: the number of Peeces and the ſorts of them, are to be according to the place and the occaſions to vſe them; *Cannon*, *Demy Cannon* and *Culuering* for Breach, and a *Demy Culuering* or two, to play vpon the Enemies Defences, with a Field-peece or two for ſingle markes. The Breadth of a Battery muſt be according to the length of the Curtin, and the number of Souldiers that muſt giue the aſſault, that nine in a ranke may at leaſt enter together.

Q. 41. *What Fire-workes are moſt ordinary and fit for warlike ſeruice, to ſpoile or annoy the Enemy moſt?*

A. Granadoes or hollow breaking balls of ſeuerall ſorts, Fire-balles for diuers vſes, as to enlighten the champion, ſticke and burne combuſtible obiects, burne and breake poiſon, or blinde the Enemy, burne in the water, or pierce the fleſh to the bone, where it fired, toucheth, Powder-pots ſimple and compound, Armed Trunkes, with Piſtols, Fire arrowes, barbed Garlands, Rowlers, Fire-pikes, and ſuch like inuentions.

Q. 42. *Of what materialls are the Granado-bals made, and what receits are they loaded with, and how armed?*

A. As they are for diuers ends (though all to deſtroy the Enemie) ſo they are made of ſeuerall materials, as of Bell-metall, ſpelter, Iron, or any hard and britle metal. To be ſhot alſo out of a Mortar Peece or *Perior*, & may alſo be thrown with the hand amongſt the Enemies: ſome are made of baked Potters clay, or of Glaſſe, and ſome of Canuas coated and armed: The receits are alſo diuers, as Powder foure ounces, Sulpher two ounces, Salpetre twelue ounces, finely

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beaten and well mixed; ſometimes Antimoney and glaſſe, and Scales or Iron: but let a britle ball be filled with powder, one pound, within two fingers height, and the reſt with Cannon powder foure ounces, and Salpetre twelue ounces, mixt and driuen cloſe together, incloſe this in Canuas, with the mouth or priming-hole downwards, and fill it, as a ball, with powder two parts, Sulpher one part, and Salpetre three parts; pierce a hole to fire at, and put into it a pinne of wood, and coat it with Roch-fire, or Roch ſulpher: alſo Powder ¼ li, Peetre 1 li & ½, Sulpher foure ounces, is an vſuall receipt: they may be made of two hollow Demy Globes of wood, bored full of holes almoſt thorow, hauing thence a touch-hole, each hole loaded with a Piſtoll bullet, the concaue filled with fine powder, and a pipe of wood coated to reach to the bottome, filled with ſlower receipt, they may be loaded with Piſtoll-pipes of iron, and powder, and bullets at each end, and a touch-hole in the midſt, their coatings may be ſtucke full of ſtones, nailes, ſhot, or ſuch like: Theſe are of great execution, but muſt euer be ſo prouided, that the ſlow fire muſt be ſure to burn vntill the ball fired be arriued at the place where it is to doe its execution; of this kinde there are infinite diuerſities and inuentions.

Q. 43. *What is that Roch-ſulpher, and Roch fire?*

A. Receipts of much vſe; Roch-ſulpher is made with one pound of Sulpher molten on a ſlow fire, and ¼ li of mealed powder, put thereto by little and little, and ſtirred wel together, and in the cooling put three ounces more of corne powder, mixing them well together. Roch-fire is made of three pound of Sulpher groſſe beaten, and ſlowly molten, to which put one pound of mutton ſewet, and therto Powder & Salpetre equally mixed, with theſe you may couer or coat *Granadoes*, *Pikes*, *Circles*, *Balls*, *Trunkes*, and *Arrowes*.

Q. 44. *What receipts for Lances, Trunkes and Firepikes vſe you, and how make you them?*

A. The formes and receipts alſo are diuers; for one may bee of Powder and Sulpher, of each one pound, Salpetre three pound, Quick-ſiluer molten with Sulpher foure ounces, Glaſſe three ounces, each beaten to powder, and tempered with Linſeed oile, boiled vntil it wil ſcald a feather, put therin; theſe put in Canuas, narrow at both ends, fitting for Pikes or Arrowes, muſt after be put on, and armed either with Wire or Marline, and coated with Roch-fire, or other coatings, or Canuas dipped in Pitch and Tallow molten, Sulpher, Rozen, and Turpentine. Lances are little different, only leſſe; Trunkes are alſo of many ſorts, moſt commonly made of wood, armed with iron hoopes, they may be eighteene inches long, beſides ſix inches bored in for the ſtaffe, w^{ch} is to be ten or twelue foot long, the eirghteene inches bored, two inches and ½ may be filled with Sulpher and Powder, of each one pound, Quick-ſiluer two ounces, Camphere one ounce, which beat with the Sulphere will become powder, mix theſe with Linſeed oyle, boiled as afore-ſaid, wowld it with Marlin, coat it and fill it with a handfull of this receipt, then with a handfull of powder, then with a button or with ſmall ſhot; couer the end with a waxed or pitched Canuas, hauing a Match or Sulpher threed goe through all. Another receipt is Cannon powder fiue parts refined, Petre

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three parts, Sulpher two parts, Rozen one part, Campheer, Glaſſe, Amber, and Maſticke mealed and ſearced, of each ½ part, well mixed with oiles of Turpentine, Petre, Linſeed, and liquid varniſh, of each ½ part. Another, take Powder three parts, Sulpher one part, Salpetre three parts, Maſticke one part, Vitrioll, white Wax, of each ſix parts, Amber, Orpiment, Arſenick, 4 parts, Verdegreaſe, Salarmoniak, each 2 parts, mixt with oiles of Linſeed, Petre, Varniſh, and Aquauitæ, of each ſix parts, and well wrought, will be a receipt of great vehemencie in burning.

Q. 45. *What are your Fire-balls?*

A. They are alſo of ſundry ſorts and vſes, ſome to light ſo, in the night, as to ſee what the Enemie worketh abroad; make a round ball of Canuas, and fill it either with Powder mealed, Sulpher, Salpetre, and Roch-ſulpher, of each one pound, mixed and preſſed hard & cloſe, and made round, it being ſewed, armed, pierced, primed, & coated with Roch-fire, rowled in corne powder, or with Roch-ſulpher molten, 1 li, Salpetre 2 li, Powder 1 li, and ½, Rozen and Turpentine each ½ li; theſe primed through in foure places, and ſhot out of a Morter or Perior without wad, will take fire and burne very light. Some balls are to burne in the water, for which take of Powder 12 oz, Sulpher 6 oz, mixt, Campheere 1 oz, paſted with boiled Linſeed oile, and oile of Turpentine and new Wax, of each 4 oz mixt with coale 4 oz, Salpetre and Roch-fire, of each 1 oz, and ½; this made in a ball, armed, primed, and coated, will not be exſtinguiſhed by Aire, Wind, nor Water. Another, for a *Morter* Peece, take a ſtone ſhot, lower far then the Bore, dip it in molten Pitch, Sulpher, Rozen and Turpentine mixed equal parts; then being warme, rowle it in corne powder, with a couer of Fuſtian dipt in molten Roch-fire, and dip it as at firſt, rowle it and couer it, vntil it be of fit height for the Peece: laſtly, dip it in Roch-fire, and rowle it in fine corne powder, and ſhoot it out of the Peece without a Wadd, loaded with $\frac{1}{1}$ of its weight in powder, and priming it downe to the ſhot with quicke powder.

Q. 46. *What are Powder-pots, Pluggs and Creſſets?*

A. Powder Pots are of baked Potters Clay, or thicke glaſſe made with foure eares; vnto which Matches lighted at both ends are to be faſtned, which filled with powder or quicke receipt, throwne among the Enemie, breakes and takes fire, and makes ſpoile. Pluggs are to be ſhot out of Ordnance like billets, but at one end, haue barbed heads of iron to ſticke, and at the other, Ropes dipt in Sope-lee and dried to fly, and not fire; yet the former receipt placed neere the barbed head, will fire any combuſtible thing it toucheth or ſtickes in. Creſſets are iron hoopes hanged on poles, to be leuell in all motions, and they are filled with tooſed match, ſoaked in Sulpher molten 3li, Salpetre 1 li, Rozen 12 oz, Olibanum, and Antimony of each $\frac{1}{2}$ li, and Linſeed oile to incorporate them together; if you will haue them reſiſt wind and raine, fill the hollowes with match well beaten, and ſoaked in Sulpher and Powder moiſtned with boiled Linſeed oile, and powder of quicke Lime and Campheere mixed; And fired, it reſiſts wind & water: but to hurt the Enemies eyes, or to poiſon them, or make fleſh fall from the bones, is not fit here to be publiſhed.

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Q. 47. *What are Fire-workes of Triumph, for pleaſure, and how, and with what receipts and conceits made?*

A. The faſhions, inuentions, and compoſitions of them are infinite, but yet they may be doubly diſtinguiſhed as their actions are double, either in the aire or water: thoſe that make their operation in the aire are either moueable or fixed; the moueable are either ſimple or compounded: the ſimple moueable, are the Rockets, the ſimple fixed, are the Truncks, Lanthorns and Lights, with ſeuerall ſorts of each: The moueables compounded, are the Wheeles, Trillers, Courtlaces, Clubs, Targets and flying Dragons: The compound fixed, are the Towers, Caſtles, Arches, Cilinders, Pyramides, and others, which of euery ſort are as infinite, as the variety of inuentions may be infinitly conceiued and wrought. Thoſe that worke their effect in the water, either are fired and placed in it, or kindled by the water it ſelfe, and they do either ſwim on the ſurface, as the Rockets, Tumbling-balls, Serpents, Dolphins, Ships, &c. or elſe burne at the bottome, as many weighty workes doe; ſome of which, when they are lighted, and become lighter then ſo much water, they aſcend, ſwim, and burne aboue.

Q. 48. *How are thoſe that operate in the aire, vſually to be made and compounded?*

A. The moueable airy Fire-works are either Rockets, or made and contriued with Rockets, they being the ſubſtructure of all the other motions: Rockets are diuerſly framed, either of paper ſix or ſeuen times double, rowled about a former, or they may be of ſtrong light timber turned hollow, or bored, or they may be made of Canuas, in length 6 times the height of their hollowneſſe (if they be vnder the weight of one pound) but if they be of more weight then foure and ½ or fiue Diametres, long will be better. Alſo for ſmall Rockets they muſt haue the quicker receipts, and for great, ſlower: As for example, the receipt for Rockets of foure ounces, may be of Powder 4 li, Salpetre 1 li, Coales 4 oz, Sulpher ½ oz; but for Rockets of a pound weight or two, take Salpetre 12 oz, of Powder 20 oz, of Coale 3 oz Sulpher viue and Scales of iron, each 1 oz, and Rockets of 8, 9, or 10 li. weight, to 8 li of Salpetre, put 2 li 12 oz of Coale, and 1 li 4 oz of Sulpher; For in the great ones no Powder muſt be put, note that theſe materials muſt be finely beaten & ſifted thorow a Searce, and wel mixed & driuen into the Rocket hard, and filled almoſt to the top euery third or fourth driuing, dipping your driſt in Gum Dragagant, and Campheere, diſſolued and mixed with ſpirit of wine or good Aquauitæ (if the Rockets be to be fired in three or foure daies) but if it muſt be a moneth or more firſt; then, in ſtead thereof, dippe the driſt ſo in oyle of Petre or liquid Varniſh and Linſeed oile mixed; if you would haue therein any breakers or Buttons, you muſt within one Diametre of the top driue a bottom of leather, or ſix or ſeuen double of paper, vp to the receipt, and pierce and prime it thorow, therunto in foure or fiue places; and you muſt alſo arme your Cane and bored Rockets leſt they ſplit: and your flyers muſt haue a ſtraight rod faſtned ſo, that within one or two fingers breadth of the Rocket it may counterpoize the ſame, for the Runners ſwiuels or a Cane faſtned is ſufficient.

Q. 49. *How make you the Starres?*

A. Take ½ oz of Gum-dragagant and lap it in Crooked-lane blacke iron plate, and roſt it in the embers, till it may be beaten to powder, then diſſolue it in *Aquauitæ*

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till it be viſcous or ſlimie, then ſtraine it, and alſo take 4 oz of Campheer, ſteep it 24 houres in other *Aqua-uitæ* vntill it be diſſolued, mix the diſſolutions together, and by little and little ſprincklingly, therewith mix theſe, powdered Salpetre 1 li, Sulpher ½ li, Powder 3 li, Coales ½ li, Amber and Scales of iron, of each 1 li, and mix them all ouer a gentle fire of Charre-coales, and make them in balls as big as you would haue them, and rowle them in mealed powder and Sulpher: you may without the Gumme and Campheere moiſten the ſame powder, only with liquid Varniſh, Linſeed oile, or oile of Petre; but the firſt, is the fairer fire for Starres. The heads of Rockets may be loaded with many things, as with powder ſtrongly lapped and armed in Paper or Parchment, with raining fire, with morcells of Roch-fire or horſe-haires dipped therein molten, Rockets may alſo be made with Barbes, to ſticke and burne whatſoeuer they light vpon, and as a ſhot, they may by a deuice be directed to any place within diſtance aſſigned. Now in regard that all moueable Fire-workes, in Aire or Water, haue their motions from the force of the Rockets applied accordingly; I need not ſpeake of them particularly, but leaue each practiſer to his owne ingenious inuention.

Q. 50. *What are your compoſitions or receipts for Water, Fires, to burne as well at the top, as at the bottome, and of thoſe that water will kindle, or that will laſt long fired?*

A. Take Maſticke one part, white Incence, Gumme Sandrach, quicke Lime, Sulpher, Bitumen, Camphere and Gun-powder, of each three parts, Rozen two parts, and Salpetre nine parts. The Campheer muſt be beaten either with Sulpher, Salt, Almonds, or water, elſe it will not be mealed. This will burne and feed vpon in the water. But to make a receipt to burne at the bottom, fill a ball with this receipt, Take Sulpher, ; li, mealed powder nine ounces, refined Salpetre one pound, and ;, Campheere beaten with Sulpher and Quick-ſiluer, put and ſtirred into the Sulpher a litle molten, all mealed and mixed by hand, and filled into a round Canuas ball, by little and little, and well driuen, being firſt moiſtned with oile of Petre, or Linſeed oile boiled vntill it will ſcald a ſeather; then arme the Ball, and prime it, balaſt it with Lead at the bottome, that the vent may burne vpwards, or a ſtone to ſinke it, and (hauing fired it well) throw it into the water, and it will burne at the bottome thereof, and fume and boile vp ſlow. Now for as much as all the before-named fire-workes, both moueable and fixed, are but by the applications of theſe or the like, I ſhall not need (neither is it poſſible) to particular all the inuentions and varieties that may be made therein: I will therefore conclude, omitting alſo perfumed ſauours and venomous ſents that may be made in Fire-workes, as not fit to be here reuealed. Next for ſuch receipts as the water it ſelfe will kindle, they are made of oyle Benedict one pound, boiled Linſeed oyle three pounds, oyle of the yolkes of Egges one pound, new Quick-lime eight pounds, Sulpher two pound, Campheer foure ounces, and Bitumen two ounces, Or elſe Roch-Petre one pound, Flowers of Sulpher nine ounces, Coales of Rotten-wood ſix ounces, Campheer one ounce and ;, oile of Egges, and oile Benedict ſufficient to paſte the mixture, with new burnt Lime vnſleyked two pound, Or vnſleikt Lime, Tutia, Roch-Petre, Loadſtone, of each one part, Sulpher, Viue and Campheer, of each

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eight parts, put theſe things in a pot filled with quicklime in powder and lute, and arme it well with ſtrong wires, and ſet it in a Lime-kill a whole burning time, and the materialls will become a ſtone that any moiſture will kindle. A receipt to carry fire alwayes in a mans pocket, is this; Take Cow-dung ſteeped foure or fiue times in ſpirits of Wine or Aquauitæ, three times diſtilled, wherein Campheer muſt be diſſolued; this muſt be well dried, being made into a Ball and kindled, it will laſt many dayes; it muſt be couered halfe an inch thick with vnſleiked Lime, and the white of Egges well mixed, and when you will vſe it, make a hole with a priming iron, and put a Sulpher match, vnto it, and it will light: And ſo Salpetre mixt with the powder of the coales of Iuniper, and the white of an Egge, wil a long time laſt kindled.

The Practice of Artillery is to bee ſold by *Humfrey Robinſon* at the ſigne of the three Pigeons in *Pauls* Church-yard.

STC 18674 R. Norton's Gunners Dialogue

Before it was rebound separately (by Robert Lunow) this pamphlet was unbound but sewn with Norton's Art of Great Artillery (STC 18676), which is now bound separately and uniformly with this pamphlet. The two had once been the first of a number of items in a thick volume. While The Gunners Dialogue was in sheets I found the collation to be as below:

A^2 B-E^4 F^2.

In all probability the two half-sheets (with one watermark) were printed as one sheet. All pairs of leaves were normally conjugate.

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